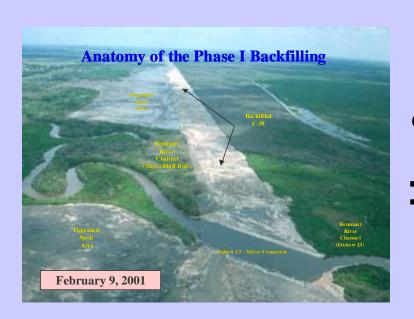
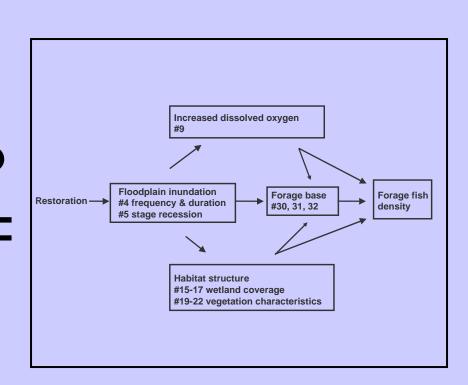
# Restoring the Kissimmee River: A Successful Evaluation Program Kissimmee River Restoration Project (KRRP)



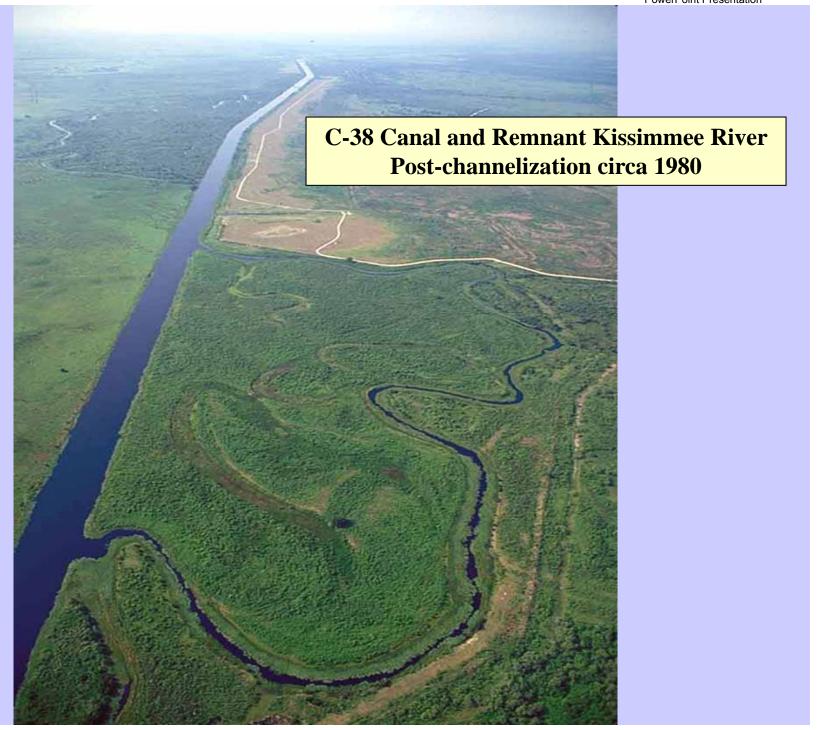
Restoration of the Kissimmee River.



Applying restoration expectations.











### Simple Conceptual Model

Restoration ---- Abjotic **Biotic** 

**Flow** 

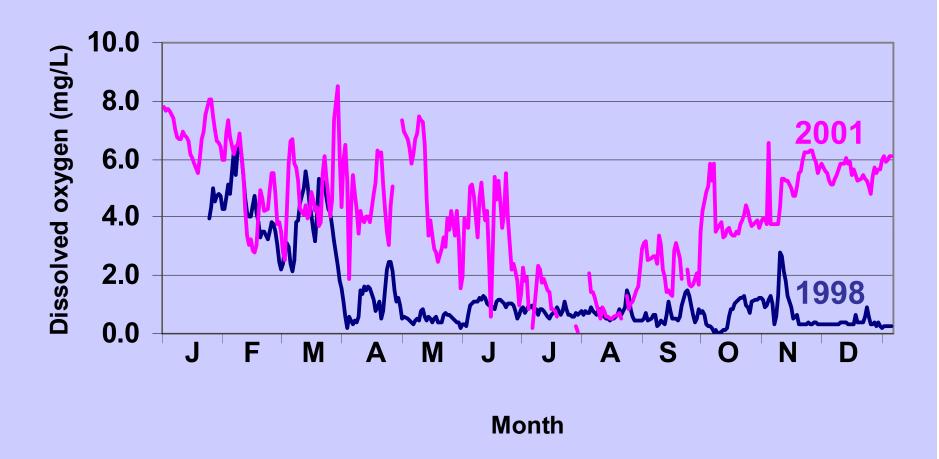
**Substratum** Geomorphic

**Hydrologic** 

**Dissolved** Oxygen

**Hydroperiod** 

Algae **Plants** Invertebrates **Fish Amphibians Birds** 



Dissolved Oxygen (1 m) before (1998) and after (late 2001) restoration

### **60 Restoration Expectations (Metrics)**

- Hydrology 6
- Geomorphology 2
- Water Quality 4
- Vegetation 10
- Invertebrates 11

- Algae 2
- Amphibians 2
- Fish 7
  - Birds 11
  - Listed Species 5

Expectations linked to an experimental design, location and frequency of measurements, methods to be used, and ways to analyze and report the resulting data.

### **Short Summary - KRRP**

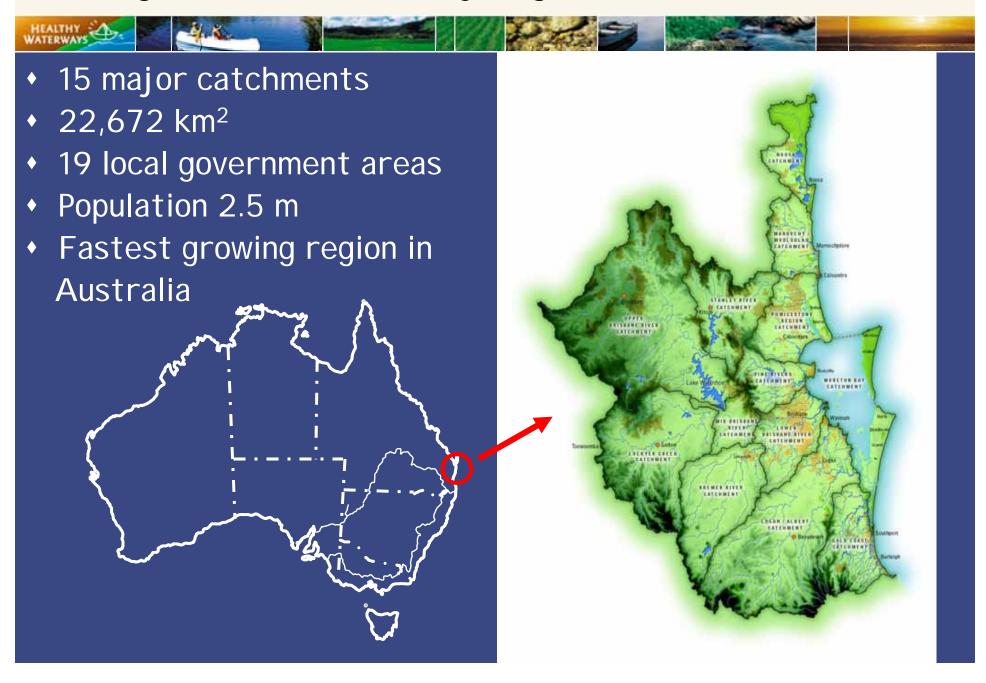
- Completed Phase I of Restoration
- So far strong positive changes in
  - River channel and wetland vegetation
  - Shore birds and overwintering birds
  - Fish communities
  - Substratum and spawning beds
  - Dissolved oxygen
- Evaluating success with clear expectations and metrics for a decade

#### Healthy Waterways Initiative - Southeast Queensland



- Study region: Moreton Bay catchments in eastern Australia - most rapidly expanding population in Australia - Brisbane area
- Development of partnership (science, managers, policy makers) to deal with issues affecting rivers and coastal waterways
- Development of science and monitoring program
- Communication with stakeholders
- Implementation of actions

#### Background to the study region



#### Formation of the Partnership

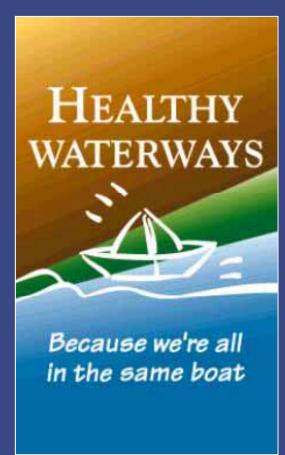


#### 3 levels of government

- Local councils (6; 19)
- State Government agencies (6)
- plus Federal funding

#### Strong research support

- 3 Universities
- CSIRO
- 3 Cooperative Research Centres



## Community & industry advisory groups (>40)

- indigenous
- conservation
- catchment & landcare
- commercial industry
- rural industry





















































#### Developing a common vision:



"South-east Queensland's catchments and waterways will, by 2020, be healthy living ecosystems supporting the livelihoods and lifestyles of people in South-east Queensland and will be managed in collaboration between community, government and industry."

#### Ecosystem Health Monitoring Program (EHMP)



Assess effectiveness of environmental protection measures (e.g. stormwater controls, STP upgrades, riparian vegetation)

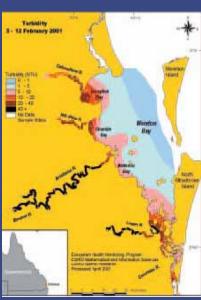


Estuarine and marine EHMP

- Designed stage 2
- Implemented Stage 3

260 sites (sampled monthly)





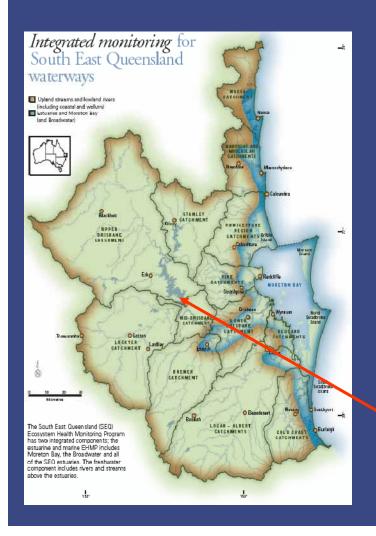


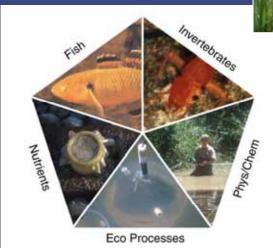
#### Ecosystem Health Monitoring Program (EHMP)



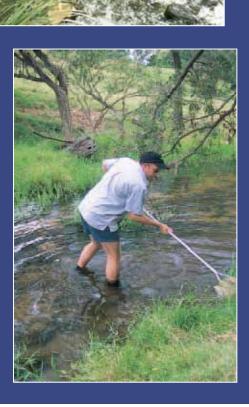
#### Freshwater EHMP

- Designed stage 3; Implemented 2002

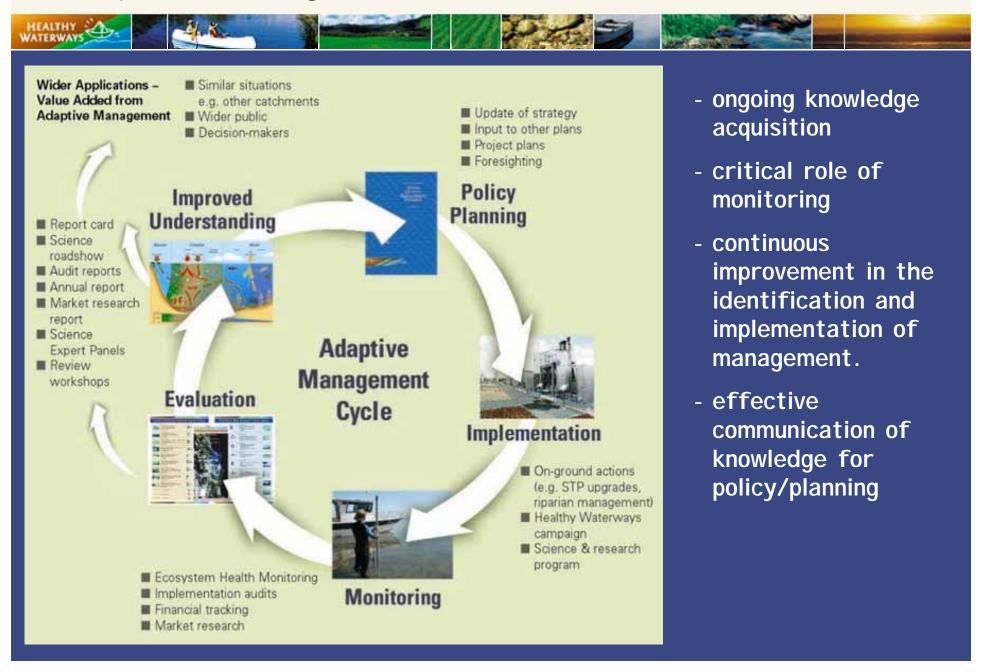




120 freshwater sites (sampled 2x/yr)

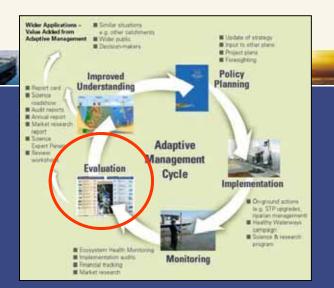


#### Adaptive management framework



#### Report cards on progress





#### **EcosystemHealth**

A comprehensive medicining program.

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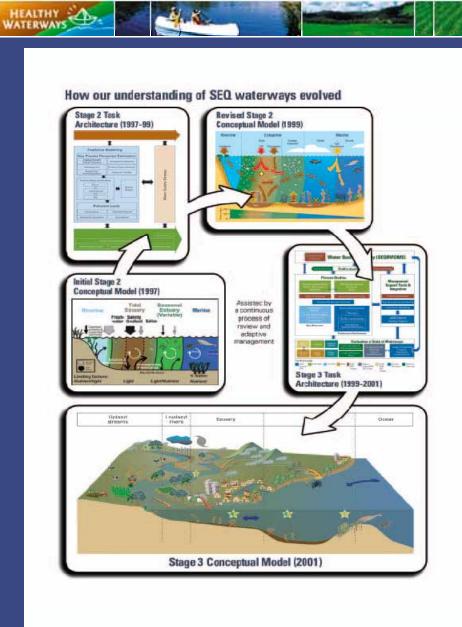
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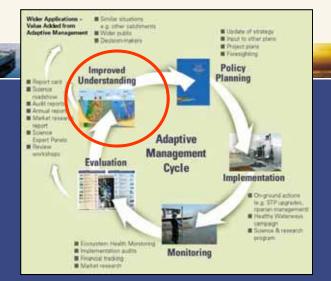
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#### Freshwater Report Card 2004 Estuarine and Marine Report Card 2004 Combued high inergenic subtletts in useer reacher Legend Massify Siver % Continued books If the nutient looking and loved paints over in upon market Manhoop Ster Since whereworks but deposed riperior nation Permanent Recogn | If General and note such with power require the pourtern page NO No Grade Delivery Day If Jan dissilate trigger and high numbers in upper resch Burtle Sec States Short Laubener There and chance generally be good complete with a signi-tic time in goods from and one entitlement with from one proprior month in the health of Cattage for Cost Cannot Say Topics Deal D Trigo subseries and Salvania dos absolved angel (Salva Salva) Deplet overlied system health stronger out with ninimal occur-ance of singue. Martinity poor would access major indications of hyanith for Storing 2000 to provide Auditor a decision or greate for most application from a C facil year to a Dire Storinger. Deserce property in the condi-tion and result actions a higher using in the absence of development property a banks in fair resort # Development and two O females. Cogni Flori From Ster. Services high number leafs but reduced from provide more O Restable # Soul wer out?" with here expen-needs in thought If for furing except source ourses being W mys summers and low dissolved oxygen levels No sater quelter monghair Secretar 6 # Pole or over male Sumantiés Greek Good water quality and import netwel hebites

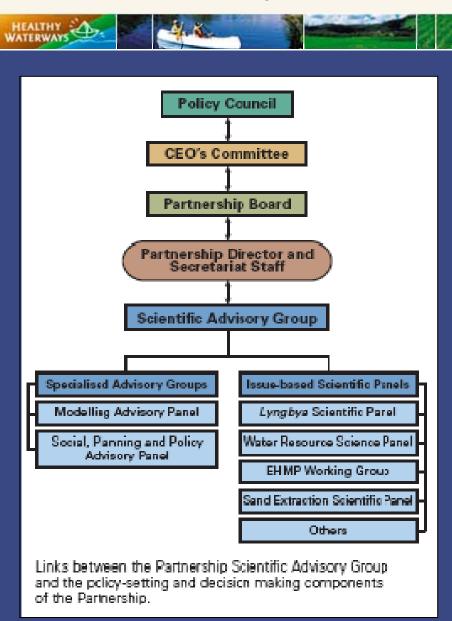
#### Improvement of understanding

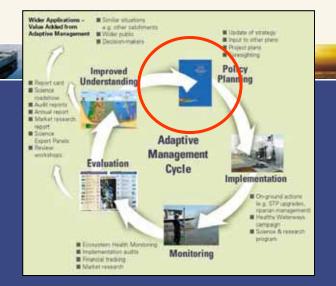




Continual refinement and testing of conceptual models

#### Links to policy





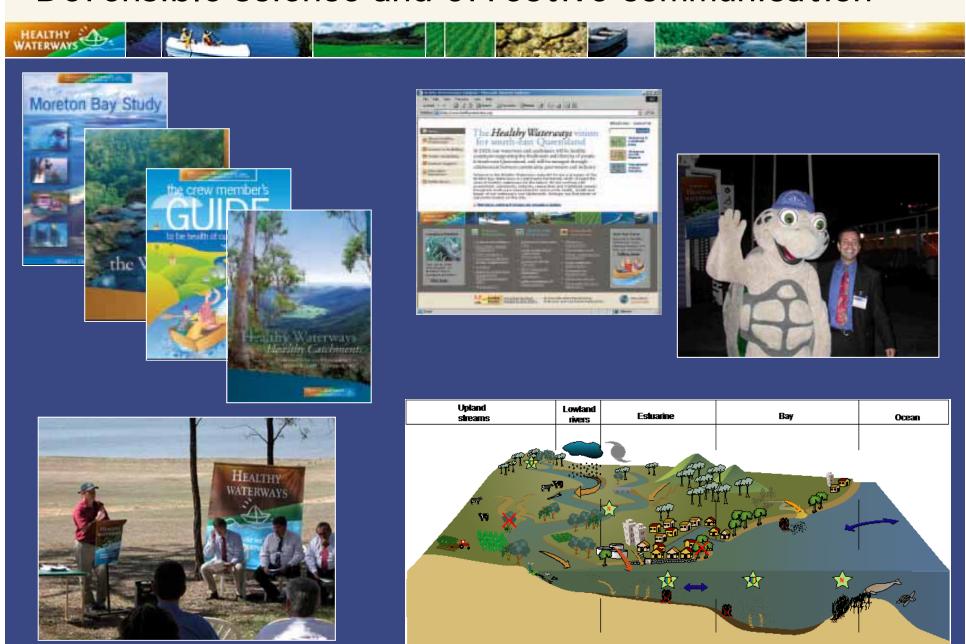
# Strong link between science and policy makers



#### Summary - Key lessons



#### Defensible science and effective communication



## **Examples of Recovery Evaluation Objectives** in the Western U.S.

#### Delta Stewardship Council

Presentation by the Independent Consultant



January 27, 2011



### Lower Columbia River Recovery and Subbasin Plan (1991-present)

- Science based objectives linked to restoration actions
- NOAA Viable Salmonid Population (VSP) framework for recovery objectives and status assessments
- Salmon/Steelhead Population Attributes abundance, productivity, and viability

• Plan includes specific strategies, measures, and actions



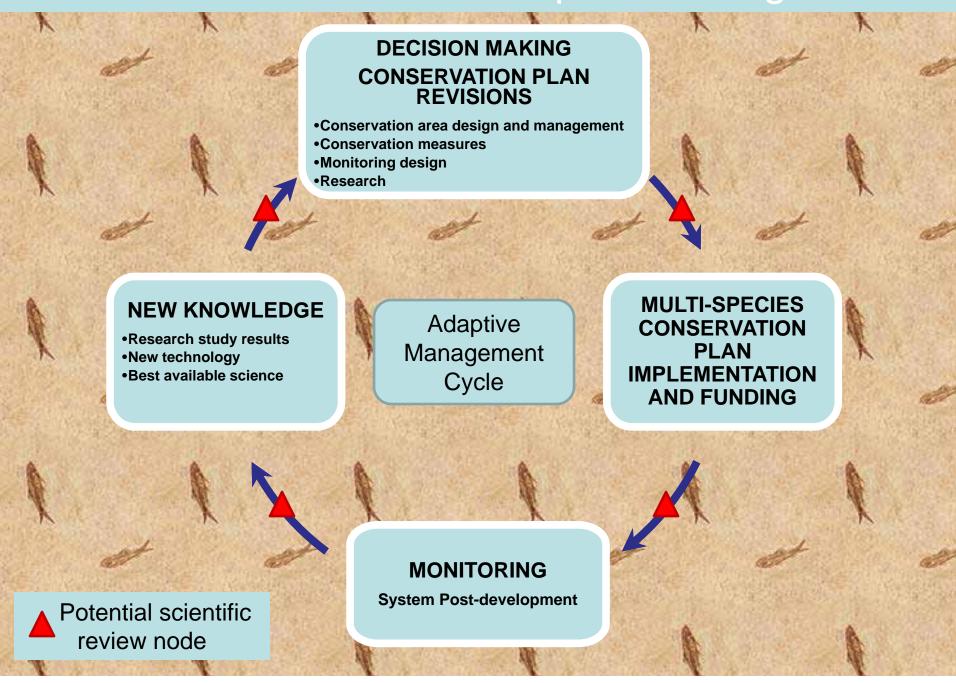
 Restoring juvenile and adult passage at barriers

Restoring estuary, floodplain, and riparian habitats

 Managing forests to protect and restore watershed processes

 Addressing immediate risks with short term habitat fixes

### Lower Columbia River Adaptive Management



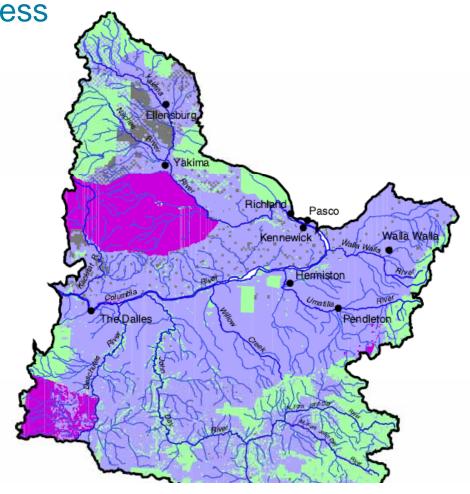
### Lower Columbia River Recovery and Subbasin Plan - Monitoring

Regional agencies monitor two aspects of performance:

Programmatic performance measures - used to track

implementation and effectiveness

 Biological and environmental performance measures used to track and evaluate restoration actions, to evaluate effectiveness and reduce uncertainty



### Lower Columbia River Recovery and Subbasin Plan - Monitoring

#### Biological status monitoring

Population parameters
 (distribution, abundance, productivity, and diversity)

#### Habitat status monitoring

Habitat type, extent, quality and use

#### Action effectiveness monitoring

 Monitors performance of management actions (measures response vs. intended effect)

#### Implementation and compliance monitoring

Monitors actions implemented

## Specific Evaluations Supporting Ecosystem Recovery Objectives

- Extent and quality of habitat
   Do habitats exhibit the ecological functions to support salmon recovery?
- Current fish use
   Are fish using those habitats?
- Protection of critical habitats
   Are there effective protection programs ?
- Habitat acquisition programs
   Is there enough existing habitat to support species recovery?
- Water quantity and timing of in-stream flows Are water flows sufficient in the streams and rivers?
- Water quality
   Is the water contaminated ?

Puget Sound Salmon Recovery Program

#### **Vision**

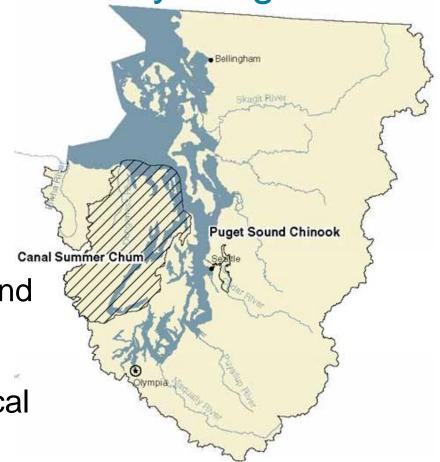
 Watershed based strategy supporting long-term functional ecosystem recovery, population viability, and stewardship

#### **Goals and Objectives**

Protect and restore nearshore and marine ecosystem processes

 Measure the viability of salmon populations and supporting critical habitats

- Develop strategies and actions to accomplish recovery
- Design regulatory programs to support protection of functioning habitats and processes



### Puget Sound Recovery Program Habitat Specific Monitoring Needs



#### Lower Colorado River Multi-Species Planning

#### Terrestrial species objectives

- Avoid/minimize/mitigate adverse impacts to covered species
- Create/maintain target habitat acreages for each species

#### Aquatic species objectives

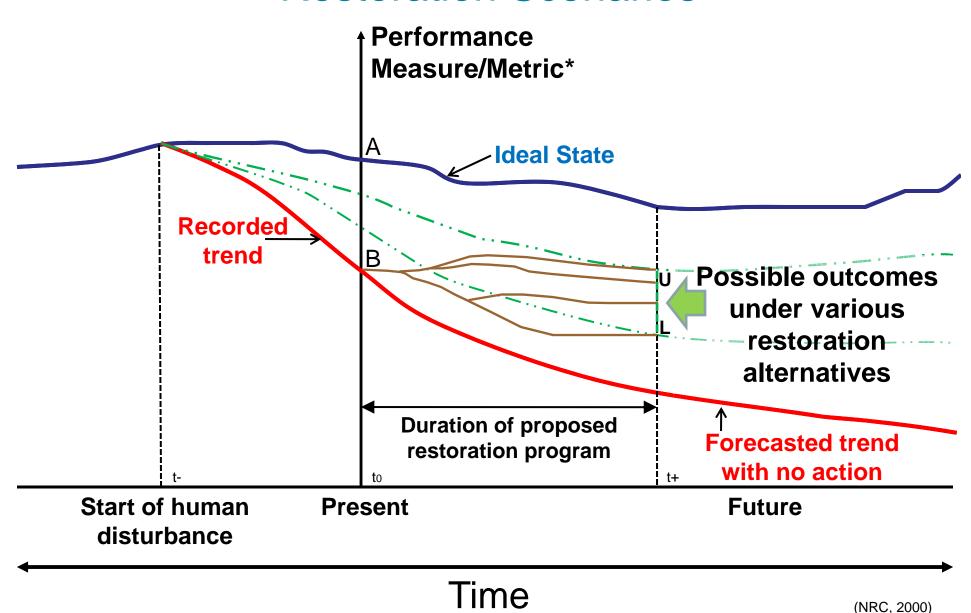
- Avoid/minimize/mitigate adverse impacts to covered species
- Create/maintain target habitat acreages and release target number of hatchery reared juvenile fish

### Avian and botanical species objectives

- Avoid/minimize/mitigate adverse impacts to covered species
- Create/maintain target habitat acreages for covered species



## Projecting and Assessing Performance of Restoration Scenarios



### **Guiding Principles for Estuary Restoration**

- Protect first restore second
- > Do no harm
- > Use natural processes to restore/maintain structure
- ➤ Incorporate fish life history
- Re-establish ecosystem connectivity and complexity
- Use history as a guide, but recognize irreversible change
- Establish performance criteria based on objectives and monitor
- Use best available science and employ a scientific peer-review process

(Simenstad and Bottom 2002)

#### **Desirable Delta Habitat Conditions**

	<b>Ecosystem Component</b>	Action
1	Internal tidally mixed Delta flows	Create upstream-downstream mixing without cross Delta flows
2	Slough networks	Create natural drainage systems for marsh habitats
3	River inflows	Develop fish-friendly flow regime
4	Tidal marsh	Expand tidal marsh throughout Delta and Suisun Marsh
5	Open water	Flood subsided islands in the Delta and diked marshlands in Suisun Marsh
6	Variable salinity	Manipulate hydrodynamic regime where possible
7	Native species abundance	Take species-specific actions
8	Activated floodplains	Expand floodplain habitat and increase frequency of flooding
9	Water quality	Reduce inputs of urban/agricultural pollutants
10 (Mo	Cooler summer habitats  byle et al. 2010)	Expand tidal marshes in areas with cooler water temperatures